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Introduction to Computer Science,
Fall semester 2010-2011
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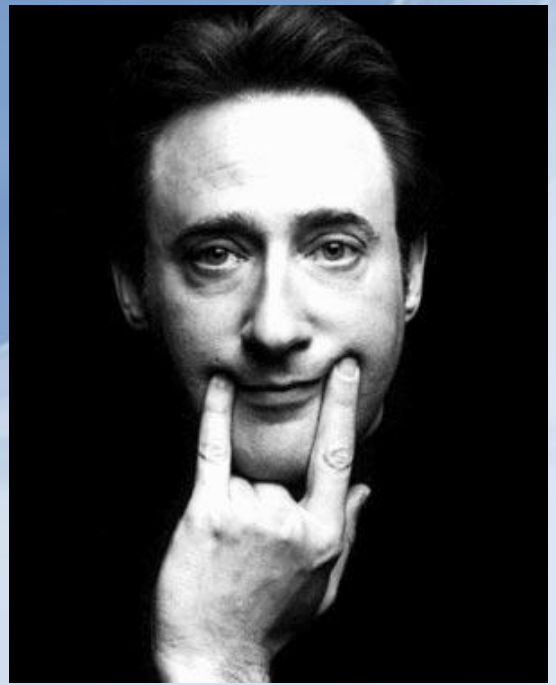
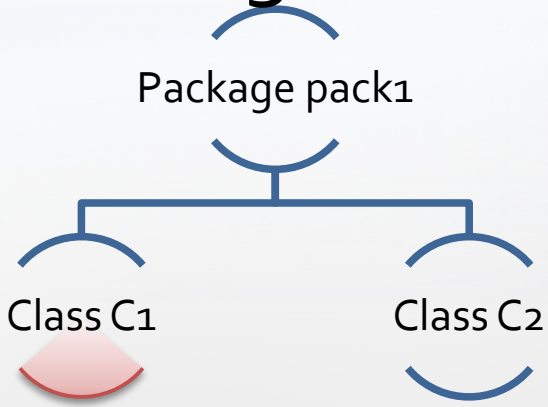
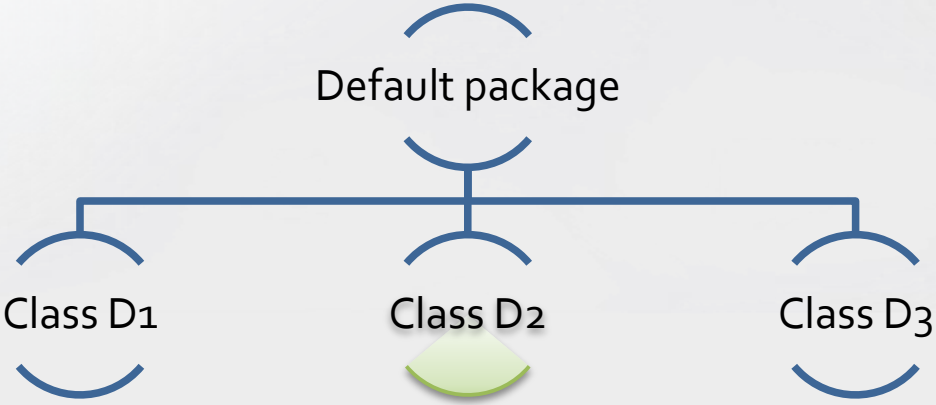


Data & Variables

"It's elementary, my dear Riker. Sir."
– Data, Star Trek (*"Lonely Among US"*)

Packages






```
package pack1;
public class C1 {
    public void init() {
        D2 d2 = new D2();
    }
}
```

```
import pack1.C1;
public class D2 {
    public void main(…) {
        C1 c1 = new C1();
        c1.init();
    }
}
```

Data

- Primitive
  - Held in primitive data types
  - Actually stored in memory as numbers
  - Assignment statements can modify data

- Complex
  - Held within objects
  - Stored as large chunks of binary data
  - Methods provide operations

Primitive Data

	8 bit	16 bit	32 bit	64 bit
Integer number	byte	short	int	long
Decimal number			float	double
Text		char		

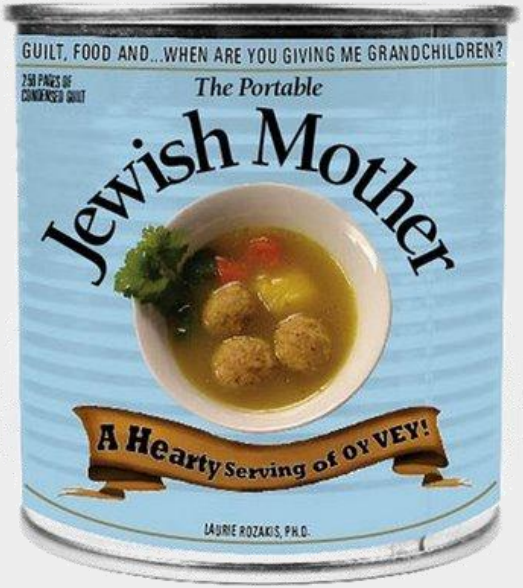
Boolean	boolean

More info:
http://download.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html

Casting (Widening & Narrowing)

- It's ok to move data from one type to another
- If the target data type is smaller, data may be lost!

- **Java is a Polish mother**
- She's concerned that you lose data
- Therefore, if such possibility exists, tell Java that you are aware of the risk (and that you'll call her later)



Examples (1)

```
public class Transportation {
        public static void main(String[] args) {
                short    smart = 2;        // 2 passengers in a smart
                int      wrangler = 5;     // 5 passengers in a jeep
                int      c4 = 5;           // 5 passengers in a Citroen
                long     train = 1000;     // 1,000 people on a train

                System.out.println("Passenger count:\nsmart: " + smart +
                        "\nwrangler: " + wrangler +
                        "\nc4: " + c4 +
                        "\ntrain: " + train);
        }

}
```

```
Passenger count:
smart: 2
wrangler: 4
c4: 5
train: 1000
```

Examples (2): avoid data loss

```
short smart = 2;
int wrangler = 5;
int c4 = 5;
long train = 1000;
```

Compiler:
"Type mismatch: cannot convert from long to int"

```
c4 = wrangler;          // move people from jeep to c4
wrangler = smart;       // move people from smart to jeep
c4 = train;             // move people from train to car
c4 = (int)train;        // move people from train to car
```

Examples (3): change type

```
Tables needed: 21
Actual tables needed: 21.0
Really actual tables needed: 21.5
Ok last time, I promise. Tables needed: 22
```

```
int students = 43;
int studentsPerTable = 2;
int tablesNeeded = students / studentsPerTable;
System.out.println("Tables needed: " + tablesNeeded);

float actualTablesNeeded = students / studentsPerTable;
System.out.println("Actual tables needed: " + actualTablesNeeded);

actualTablesNeeded = (float)students / studentsPerTable;
System.out.println("Really actual tables needed: " + actualTablesNeeded);

int remainderTable = (int)(actualTablesNeeded -
                           (int)actualTablesNeeded + 0.5);
        // ..or any other creative solution (using %, for instance)
System.out.println("Ok last time, I promise. Tables needed: " +
                           (tablesNeeded + remainderTable));
```

Classes & Objects

- A class is a complex data type which offers:
  - Internal variables (“state”)
  - Functionality (“methods”)
- Some classes provide only methods, some provide both

Definition Classes

- Provide both state and methods
- You can create many objects, each with its own state
- You can invoke an object method
- The method can change the object's state
- The method can return a value
- You can work with that value

Example

- How would you represent a 2 dimensional point?
  int X, Y? float X, Y?
- Consider a definition class called Point which "encapsulates" both X and Y.
- It also provides you with some functionality to change its state or inquire about it.

Example

```
Point p1 = new Point(0, 0);
Point p2 = new Point(10, 10);
int x1, y1;

x1 = p1.getXCoordinate();
y1 = p1.getYCoordinate();
System.out.println("p1 is at (" + x1 + ", " + y1 + ")");
System.out.println("p2 is at (" + p2.getXCoordinate()+ ", " +
        p2.getYCoordinate() + ")");

p1.moveOnXAxis(-10);
p2.moveOnYAxis(20);
x1 = p1.getXCoordinate();
y1 = p1.getYCoordinate();
System.out.println("p1 is at (" + x1 + ", " + y1 + ")");
System.out.println("p2 is at (" + p2.getXCoordinate()+ ", " +
        p2.getYCoordinate() + ")");
```

```
p1 is at (0, 0)
p2 is at (10, 10)
p1 is at (-10, 0)
p2 is at (10, 30)
```

Container Classes

- Don't have state!
- Just a bunch of stand-alone methods, packed into a single class, only because it made sense.
- Example: Math, a bunch of mathematics-related methods, with no state
- Usage:

```
int g = 10;
float x = Math.sqrt(g);
```

Example, Class String

- Interesting methods:
  - indexOf, substring, toUpper, toLower, replace, more (see API)

```
String input = "Seatec Astronomy";
String output;
int spaceIndex = input.indexOf(" ");
String firstWord = input.substring(0, spaceIndex);
```

```
Astronomy Seatec
STEVEN SEAGAL
```

	Returns a new character sequence that is a subsequence of this sequence.
String	substring(int beginIndex) Returns a new string that is a substring of this string.
String	substring(int beginIndex, int endIndex) Returns a new string that is a substring of this string.
char[]	toCharArray()

```
"ven ").toUpperCase()
perCase();
```

Example, Class Random, Scanner

```
import java.util.Random;
import java.util.Scanner;

public class RandomGames {
          public static void main(String[] args) {
                    Random randomGenerator = new Random();
                    Scanner inputScanner = new Scanner(System.in);
                    System.out.print("Enter range (minimum maximum): ");
                    int minimum = inputScanner.nextInt();
                    int maximum = inputScanner.nextInt();

                    int random = randomGenerator.nextInt(maximum - minimum + 1) + minimum;

                    System.out.println("Result: " + random);
          }
}
```

Do we have time to..

- Write a game?
- Solve exercise 2?